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NPIC/TSSG/RED-1750-69
6 August 1969

MEMORANDUM FOR THE RECORD

Declass Review by
NIMA/DOD

SUBJECT: Light Table for Versatile Stereoscope

1. The purpose of this memo is to present the results of an effort to reduce the noise on the Light Table for the Versatile Microscope. It is not a scientific report in that it does not present all of the supporting data and calculations, but merely a summary of the results and some of the details of the test procedures.

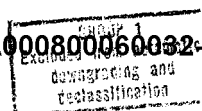
2. Under Contract [] the development of the subject light table was begun by [] but the contract was not completed due to excessive projected costs. [] the Project Officer, continued to develop the light table in-house. His efforts included procedures to reduce the noise of the film drive. In March, 1969 I as given the task of continuing the development to reduce the noise level of film drive.

3. Included in techniques used to reduce the noise level were (listed in approximate order of their effect on noise reduction):

- a. Reduction of motor rpm
- b. Reduction of the number of gears
- c. Use of non-metallic gears
- d. Replacement of noisy bearings
- e. Use of constrained layer damping material
- f. Use of enclosure.

4. The original design had eight steel gears on each of two film drives. By re-designing the drive slightly, two gears were removed. The ratio of motor rpm to film spool rpm was thus reduced from about 30 to 1 to 10 to 1 or to one-third. Thus, two effects are gained: for a given output rpm, motor speed is only one-third as fast as the original design, and two less gears are used. These two changes reduced the noise level about 10 db, depending on speed. Using the []

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25X1 [] sound recorder, frequency octave bands were recorded at 60 and 360 rpm both with and without tension on the film (see sample graph attached). It can be seen that the noise has a fairly wide band width. Some of the peaks in the graph can be associated with frequencies produced by the gears. Other peaks are not so easily explained.

5. Both phenolic and nylon gears were used to replace three of the six steel gears on the new design. There was no appreciable difference between the two non-metallic gears tried. Either phenolic or nylon gears did reduce noise a small amount. The non-metallic gears used were of a higher quality than the steel ones.

6. Two noisy bearings used on idler rollers were replaced. No measurements were taken to determine the effect of this change but it is assumed to be small.

25X1 7. A [] constrained layer damping material (LR-604) made of an especially formulated urethane was tried. In theory, this material converts sound vibrations into heat and reportedly can reduce noise by about 10 db. However, no measurable effect was realized with this material. Other experiments were performed with softer damping mounts but non-rigid mounting of the gear assembly caused slippage of the chain between this assembly and the spool brackets.

8. An enclosure designed to cover the entire gear assembly did not reduce the noise level.

9. The motor was removed and the output shaft was turned manually. The maximum speed could not be attained in this manner, but at 60 rpm, the noise level was about the same whether or not a motor was used.

10. Using the best techniques in combination, the noise level at 60 rpm of the film spool is about 57 db compared to 74 db with the original design. At about 360 rpm the noise level is reduced from 88 to 79 db. However, the film spool speed can now be increased by nearly three times because of the new gear configuration. At the max motor speed for either the original or new drive (about 14,000 rpm) the noise is nearly the same.

11. For a given film spool rpm, noise can be reduced with the changes just described, but the noise is still considerably above the NC-40 curve recommended in the Human Engineering Design Guide on page 3-5. If both drives were converted to the new design, the two drives would still contain; two motors, 4 idler rollers, 12 gears, 12 sprockets, 4 chains and numerous bearings. It has been shown that even without the

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motor, noise levels are still well above the recommended NC-40 curve. In fact, at 360 rpm of the film spool, the noise is above the NC-70 curve.

12. In order to significantly reduce the noise level, it will be necessary to modify the design more than originally anticipated. It is apparent to me that [] proposed modifications to the table would not have been successful in reducing the noise level appreciably. By performing this work in-house, NPIC has thus saved the [] requested for the modification.

[]
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